

THE ACTION OF DRUGS ON PLANT-GROWTH.

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THE action of medicines on the growth of vegetable tissues is a subject which has received but little attention. That plants have periods in which their growth is hastened and inhibited has been known for some time. Plant-growth generally takes place between 6 P. M. to 10 A. M. the next day, after which it is partially arrested till 4 P. M., when activity again ensues.

There are two well-marked epochs in the period of plant-growth, one from 7 P. M. to 3 A. M.; the other from 7 A. M. to 10 A. M. These intermissions in growth are due to the effects of light and heat. The light inhibits growth, whilst heat accelerates it. To more accurately measure the growth I used Stöhrer's apparatus, fig. 1. *A* is a clock into whose side fits the cog-wheel *B*. The movement of a wheel within the clock moves the wheel *B*, upon whose axis is a disc which holds a paper ruled in divisions corresponding to the twenty-four hours of a day, each half representing twelve hours. Each hour-division is moved past the pen on the lever *D* as the hand on the dial of the clock moves through its hour-division, that is, when the hand on the dial of the clock points to a certain hour, the lever *D* points to the same hour on the disc *C*. In Stöhrer's arrangement a point of lead projected against the paper by a spiral spring marked the breaks on the disc. As the spring did not always act, not making a mark on the paper at times, I put

on the end of the lever *D* a pen of aluminum, which moved over the smoked paper on the disc *C* and made a quite legible tracing. This smoking of the paper does not prevent one from reading the hour-numbers lithographed on the paper fastened to the disc. It was found that smoking the paper made it roll up at its edges. To obviate this I had a grooved ring surround the disc, the paper and metallic edge of the disc being in the groove. This ring was made so that it could be easily detached, and when on was held together by a metal clasp. The plant in the pot *E* had its tip attached to the thread *P* by means of adhesive plaster. Now, as the plant grows upward, the counter-poise *O* causes by its descent the wheel *K* to revolve. As this wheel *K* revolves, the notches on its side move the lever *I* and lift its point out of the mercury cup *H*, which breaks the current coming from the battery *F* and demagnetizes the magnets, which causes the lever to move and inscribe a break on the smoked disc *C*. Further revolution of the wheel *K* by the growth of the plant closes the current, and another break is made on the smoked disc. After a normal day has its tracing made, another tracing is made inside of it, on the next day, by simply changing the wires connecting with the screws and magnets. The window in which the plant was placed was directed toward the north, and received the sun's rays only during the afternoon.

The plant selected was an ivy, the *Senecio Scandens*. The apparatus was attached to the plant by means of a strip of adhesive plaster, doubled over near the tip of the plant. Then a thin silk thread was passed through the plaster to prevent it spreading, and a small hole afterward cut into it so as to admit a hook. The plaster compresses the stem but little, for the compressing force is distributed over a quarter of an inch. Then the upward growth of the plant was allowed to automatically register its increase on the

smoked disc. In making the experiment, I have kept the following points in view so as to avoid errors: 1. The moisture of the air may influence the length of the thread. 2. The moistening of the ground has an influence on the amount of growth, making it greater than it is. 3. The plant's stem must be erect, and the plant should be fixed in the earth for some weeks. 4. The tip of the plant must have the adhesive plaster as near it as possible on each day of the observation. If the plant grows rapidly, the adhesive plaster is placed nearer the tip each day.

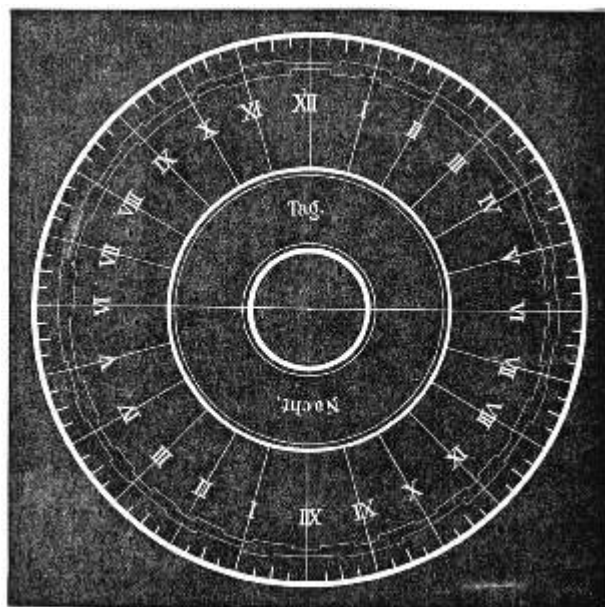


FIG. 2.

1st day.—Temp. 83° F.

2d day.—Temp. 84° F.

Inner circle. Morphia action—xxx grs.

During the experiments the temperature was noted on each day. The circummutation was overcome by the weight. The earth about the plant was watered on each day with the same amount of water, except on the drug-day it contained the medicinal substance in solution. All the conditions of the plant were kept as nearly similar as possible. When the sulphate of morphia in ten- and thirty-grain doses was added to the water moistening the earth about the plant, it was found that the growth of the plant was ac-

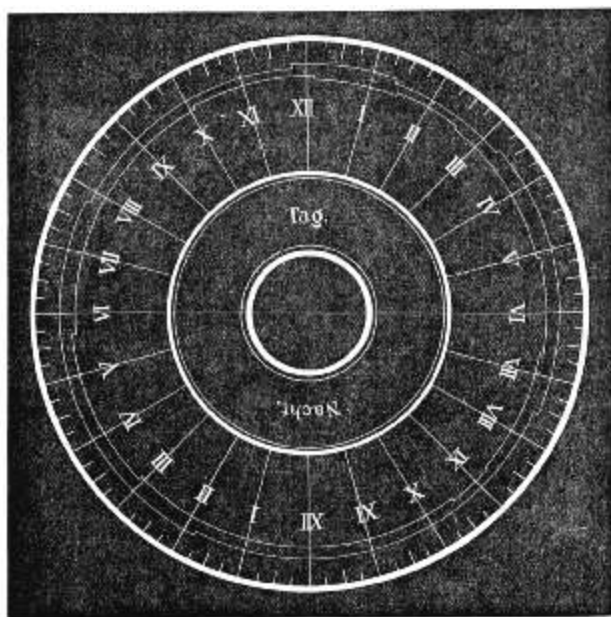


FIG. 3.

1st day.—Temp. 86° F.—Inside line normal.
 2d day.—Temp. 84° F.—xxx grs. of chloral hydrate.
 The attachment changed on the second day nearer the point.
 Plant dying on the second day.

celerated, as is seen in fig. 2, where the breaks are more numerous in the inner circle than in the normal outer circle, the excess of breaks being three. Subsequently the plant retained its growth and vitality. When thirty-grain doses of hydrate of chloral were added to the soil, the arrest of growth was considerable, as is seen in fig. 3, the outer circle representing the stoppage of growth by the chloral. The plant began to die on the day after the chloral had been administered. When chloroform was added to the soil to the extent of three drachms, the growth of the plant was greatly arrested.

Ether to the amount of three drachms, when added to the soil about the plant, also caused an arrest of growth, but much more slowly than chloroform did. The death of the plant took place much more slowly.

These experiments on vegetable protoplasm still further confirm the toxic power of chloral and chloroform. The action here is not on any nervous system, as plants have not been found with any. It is to be inferred that the use of chloral and chloroform have a direct action on protoplasm in general, as well as on nerve protoplasm. The less-marked effect of ether compared with chloroform confirms the views now generally held, that the latter is far in excess in toxic activity compared with ether. That morphia should stimulate vegetable protoplasm is a rather unlooked-for result. It certainly shows that its effect on protoplasmic activity is not to rob it of its vitality so readily as chloral does. In another article I propose to take up other drugs and their relations to vegetable protoplasm.